

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



A 423.7  
F 764

# Annosus Root Rot in Eastern Pines

By Harry R. Powers, Jr.,<sup>1</sup> and John S. Boyce, Jr.<sup>2</sup>

The fungus *Fomes annosus* causes a root and butt rot of conifers in many temperate parts of the world. Annosus root rot damage now appears to be increasing in the Eastern United States, especially in planted forests following thinning. In some areas losses are already heavy, and with large acreages of plantations now reaching thinning age, this disease is causing increasing concern among foresters.

## Distribution

*Fomes annosus* is prevalent throughout the North Temperate Zone, and has also been found in some tropical and subtropical areas. The fungus is native to this country and can be found wherever conifers are grown. Killing by annosus root rot has been reported in most eastern States, but serious losses have not occurred in any entire State.

A survey in 1961, covering the East and South, showed that annosus root rot damage occurred in some thinned pine plantations throughout the entire area, although the pine species surveyed in the South were different from those examined in the Northeast. The incidence of annosus root rot

was higher in the coastal States from Virginia through Texas than in the Northeast. Within this southern region, however, there was much variation in damage between specific areas, from localities several counties in extent with almost no damage to others with consistently high losses. In general the results showed that the Southeast had the highest incidence of disease of any area surveyed.

## Hosts

In the East, annosus root rot has been found killing loblolly, longleaf, pitch, red, slash, shortleaf, Virginia, and white pines. The fungus attacks many other conifers and is a major cause of death of eastern redcedar. Most of our native conifers are probably susceptible to infection under some conditions, but their relative susceptibility is not yet known.

The disease has been reported on several hardwood species in Europe, but in general deciduous trees are much more resistant than conifers. There have been no reports of living hardwoods infected by *Fomes annosus* in this country, although fruiting bodies have been occa-

<sup>1</sup> Forest pathologist, Southeastern Forest Experiment Station, Forest Service, U.S. Department of Agriculture, Asheville, N.C.

<sup>2</sup> Formerly forest pathologist, Southeastern Forest Experiment Station, Forest Service, U.S. Department of Agriculture, Asheville, N.C.; now professor, Department of Plant Pathology and Plant Breeding, The University of Georgia, Athens.



sionally found growing on the bark of hardwoods.

### Signs and Symptoms

*Fomes annosus* produces fruiting bodies, or conks, with a light gray to dark-grayish brown upper surface. The undersurface is creamy white, with small pores. This spore-producing undersurface darkens with age. Conks are perennial; however, under some conditions they may be destroyed after a relatively short time and

therefore seem to be annual. Conks are irregular in shape and range in size from very small buttons up to brackets several inches across. They are formed on stumps, slash, dead trees, and at the root collar or on roots of living infected trees.

Conks are characteristically found at or even below the ground line (fig. 1), and it is often necessary to remove the duff at the base of the tree to see them. In some instances, matlike fruiting bodies are formed in the needle litter.



F-501993

FIGURE 1.—Conk of *Fomes annosus* at ground line of dying pine.



These spore-bearing structures are irregular masses of fungus tissue and imbedded needles. Such fruiting bodies are often seen at some distance from any tree, but an attachment with a superficial root can usually be detected.

*Fomes annosus* fruiting bodies may be abundant in some stands and absent or scarce in others. They can be easily overlooked because of their inconspicuous color and obscure location.

Pines in the earlier stages of infection can sometimes be recognized by the thin appearance of their crowns compared with nearby healthy trees. This thin appearance is due to short needles and short twig internodes resulting from reduced tree vigor. Infected trees often do not show these symptoms, however, since even trees with extensive root rot may have full, green crowns.

Where residual pines or other conifers die within a few years after the stand was thinned, annosus root rot should be suspected. The pattern of group killing by *Fomes annosus* closely resembles that of bark beetle killing, and careful examination is necessary to distinguish between the two. Furthermore, some trees weakened by annosus root rot are attractive to certain bark beetles, and both *F. annosus* and bark beetles may attack the same tree. Finding conks on living trees attacked by bark beetles gives strong evidence that root rot developed first and bark beetles followed.

*Fomes annosus* causes a light-yellowish stringy rot. The advanced stage is typified by narrow,

elongated whitish pockets that run together and reduce the wood to a spongy or stringy mass. Black spots or flecks sometimes occur in the rot pockets. The characteristics of annosus-rotted wood are seen best in broken roots of wind-thrown trees. Decayed roots are often shredded and stringy at the break (fig. 2), in contrast to the sharp, firmly splintered breaks of sound roots. An irregular pinkish to dull violet stain of the sapwood in both roots and butts indicates incipient decay.

### Means of Spread

The manner in which *Fomes annosus* invades a healthy stand and its method of subsequent spread are not fully understood. Most infections, however, are initially related to the presence of stumps and therefore to thinning. One view is that new infections start mainly from airborne spores that fall upon the freshly cut surfaces of stumps. Once established in a stump, the fungus can spread into the roots. Roots of adjacent healthy trees may in turn become infected where they are in contact with these diseased roots. In the South the entire process of infection, spread through roots, and killing of residual trees may occur within as little as 2 years following thinning.

Since *Fomes annosus* is already widely distributed, some stump infections may be expected to develop in many pine stands when they are thinned. However, not all stump infections lead to later mortality of residual trees; conks frequently occur on stumps in healthy stands.





F-501991

FIGURE 2.—The typical stringy rot caused by *Fomes annosus* in a white pine.

### Damage

*Fomes annosus* causes damage to pines mainly through outright killing, although there may be some cull from butt rot. Groups of trees or single trees scattered throughout a stand may be killed. Pines may also be windthrown because of extensive root rot (fig. 3).

A recent survey of 585 randomly distributed thinned pine stands, ranging from New England to Texas, has shown that the average damage from annosus root rot is fairly low at the present time. However, there was much variation in damage among specific areas within this region, from those with almost no damage to others with consistently high, often ruinous losses. Plantations were much more severely attacked than natural stands, sometimes with as many as 30 percent of the residual trees

dead or dying of annosus root rot following a thinning (fig. 4).

Loblolly pine plantations had the highest apparent incidence of any species surveyed, as well as the highest average damage. Fifty-nine percent of the loblolly plots surveyed had some mortality due to annosus root rot, and 2.8 percent of all loblolly trees examined were dead or dying of this disease. The figures for slash pine plantations were slightly lower, both in regard to disease incidence and average damage.

Red pine plantations were the least affected, with less than one-third of the plots having mortality and an average of only 0.6 percent of all trees dead or dying of annosus root rot. Although survey data are not available for white pine, some thinned plantations in the southern Appalachians have been seriously damaged.

Two of the most significant findings of the recent survey were the





F-494586

FIGURE 3.—White pines windthrown following extensive root rot caused by *Fomes annosus*.

very low mortality rates for natural stands as compared with plantations, and the low level of damage in stands on land continually forested in comparison to those on former cropland. Survey data also showed that damage generally increased as years since the first thinning increased, and also with more frequent thinnings. Stands on coarser textured A horizons suffered more damage than those on heavier soils. Damage also tended to increase with increasing depth of the A horizon. Plots on slopes, however slight, suffered more damage than those on flat sites. Losses were also heavier in stands with deep forest litter than those with little or no litter.

One point stands out clearly: the

highest losses occur in plantations in conjunction with thinnings. The fact that a large proportion of the tremendous acreages planted to pines in the East and South is just reaching thinning age makes this aspect especially serious.

### Control

The definite relationship between thinning and damage from annosus root rot has focused attention on the possibility of control by stump treatment. British research has indicated a reduction in the number of stump infections when certain chemicals, such as coal-tar-creosote or urea, are applied to freshly cut stump surfaces. This direct control method is being tested in





F-501992

FIGURE 4.—A planted stand of slash pine in South Carolina breaking up from annosus root rot following thinning.

this country to determine whether it is sufficiently effective under eastern conditions to warrant the expense involved. Pending results of these and other tests designed to show how best to avoid or control annosus root rot, the following suggestions are offered for management of slash, loblolly, red, and white pine plantations:

1. Thin only once, and delay that as long as economic and silvicultural considerations permit.

2. If thinning can no longer be delayed, apply a wood-preserving grade of coal-tar-creosote to exposed stump surfaces *immediately* after cutting during the *first* commercial thinning. This presumes that the forest manager is willing to make some additional investment in order

to reduce the risk of possible later major losses.

3. No control is recommended in stands where annosus root rot has done little damage despite thinning, or in stands low in potential value.

Any unnecessary cutting of even an occasional living tree in plantations should be avoided, because scattered stumps can serve as centers of infection.

Several silvicultural measures have been advocated for annosus root rot control in Europe. Their value in this country has not been adequately tested. Among these measures are planting conifers only on sites to which they are well adapted, planting in mixtures with hardwoods or other conifers, and



planting with wide spacing. Wide spacing in the South, using loblolly and slash pine, would have definite disadvantages, however, because the possibility of damage from fusiform rust increases with width of spacing.

In plantations already established, thinning with chemicals to avoid creating stumps may have advantages from the root rot standpoint. Poisoning has been tested on a limited scale in white and red pine plantations, and has resulted in less annosus root rot infection than when trees were cut.

Surveys show that natural stands, even when thinned, suffer much less annosus root rot damage than plantations. This suggests that stand establishment by direct seeding may reduce root rot losses on high-hazard sites.

## Annosus in the West

The information given in this leaflet is directly applicable only in the East. *Fomes annosus* is also important on conifers in the West, but there it may differ significantly in details of behavior.

## References

- ROOT ROT IN PINE PLANTATIONS. JOHN S. BOYCE, JR. *Forest Farmer* 19(3): 8, 17-18. 1959.
- ROOT AND BUTT ROT IN PLANTED WHITE PINE AT BILTMORE, NORTH CAROLINA. GEORGE H. HEPTING and ALBERT A. DOWNS. *Jour. Forestry* 42: 119-123. 1944.
- FOMES ANNOSUS. WHAT IT IS AND HOW TO RECOGNIZE IT. PAUL V. MOOK and HAROLD G. ENO. U.S. Forest Serv. Northeast. Forest Expt. Sta. Paper 146, 33 pp., illus. 1961.
- FOMES ANNOSUS ON SLASH PINE IN THE SOUTHEAST. H. R. POWERS, JR., and JOHN S. BOYCE, JR. *Plant Dis. Rptr.* 45: 306-307. 1961.



CURRENT SERIAL RECORDS

MAY 16 1963

U. S. DEPT. OF AGRICULTURE  
NATIONAL AGRICULTURAL LIBRARY